

CLAIMS, Set 1

Claims 1-15 (previously canceled).

16. (amended) A method for providing [comprehensive] fire prevention [and suppression] in an aircraft having an engine, [a fuel tank containing fuel and a human occupied compartment,] by producing oxygen-depleted air from a bleed air received from said engine, said method comprising:

separating said bleed air into an oxygen-enriched gas mixture and an oxygen-depleted gas mixture;

removing said oxygen-enriched gas mixture by discharging it outside the aircraft;

supplying said oxygen-depleted gas mixture into a space inside said aircraft [said fuel tanks] for establishing therein a hypoxic fire prevention [fuel ignition suppression] environment [in order to prevent ignition of said fuel in said fuel tanks]; maintaining the oxygen content in said [fuel ignition suppression] hypoxic fire prevention environment in the range from greater than 12% [9%] to approximately 16% of oxygen;

17. (amended) The method of claim 16, wherein the aircraft space further comprises a cargo compartment, and the method further comprises the step of:

supplying said oxygen depleted gas mixture into said cargo compartment;

[establishing a hypoxic environment in said cargo compartment, wherein said hypoxic environment in said cargo compartment contains oxygen in the range from greater than 9% to approximately 16% by volume;] and

maintaining said hypoxic fire prevention environment in said cargo compartment.

18. (previously presented) The method of claim 16, wherein in case of an emergency, supplying said oxygen enriched gas mixture, via respiratory masks, to passengers and crew in said aircraft;

automatically deploying this supply when a signal from a smoke and fire detection system received or a depressurization of the cabin being detected.

19. (amended) The method of claim 17, wherein said cargo compartment is constantly ventilated with said oxygen depleted gas mixture having oxygen content from 12% to 15.5% [16%].

20. (Amended) The method according to claim 16, [wherein] further comprising [when needed, the] mixing of said oxygen-depleted gas mixture with said bleed air [is provided in order] to increase and regulate the oxygen content in [the cabin and different compartments of the] said aircraft space;

hypoxic gas mixture from said mixing device [is] being supplied in amount equal to or larger than any [amount of] air leaking from [the] said aircraft space [protected compartment] allowing to maintain a desired oxygen content by ventilating the compartment with said hypoxic mixture.

21 (Amended) The method according to claim 16, wherein said oxygen-depleted gas mixture is supplied directly into [protected compartment] said aircraft space allowing to achieve and maintain the desired oxygen content by diluting said space's [compartment's] atmosphere with the oxygen-depleted gas mixture.

22. (Amended) The method according to claim 17, wherein said oxygen-depleted gas mixture is used to propel water through a special nozzle for generating water mist inside said aircraft space [the protected compartment in order] to suppress a fire.

23. (withdrawn) The method according to claim 17, wherein said oxygen-depleted gas mixture is used to propel a foam generating solution through a foam producing device for generating hypoxic fire-extinguishing foam inside a protected compartment.

24. (previously presented) The method according to claim 16, wherein a plurality of oxygen-separation membranes is used for separating said bleed air by connecting them in parallel in a single unit, so a failure of one membrane does not affect significantly the performance of the whole device.

25. (previously presented) The method according to claim 16, wherein a plurality of pressure-swing adsorption units is used for separating said bleed air by connecting them in parallel in one module, so a failure of one unit does not affect significantly the performance of the whole device.

26. (Amended) The method according to claim 16, wherein providing of a pressurized container having sufficient amount of said hypoxic air in order to flood or accelerate the flooding of [the passenger cabin] said aircraft space and establishing there a breathable fire-extinguishing atmosphere in a case of a fire.

27. (previously presented) The method according to claim 16, wherein a cryogenic method is used for producing nitrogen and oxygen from atmospheric air and said oxygen-depleted gas mixture being made by mixing nitrogen with the bleed air.

28. (Amended) A system for providing [comprehensive] fire prevention [and suppression] in an aircraft, said aircraft having an engine, [a fuel tank and at least one human occupied compartment], by producing oxygen-depleted or hypoxic air from a bleed air, said system comprising:

an air-separation device receiving said bleed air from said aircraft engine and separating said bleed air into first and second gas mixtures; said first mixture being oxygen-enriched air and said second gas mixture being oxygen-depleted air;

a venting means for releasing said first gas mixture outside the aircraft;

means for supplying said second gas mixture into a space in said aircraft [said fuel tanks and said at least one compartment for ventilation] and maintaining there a constant hypoxic fire-preventive environment in order to prevent ignition that can lead to explosion or fire; the oxygen content in said fire-preventive environment is maintained above 12% [9%] and below 16%.

29. (Amended) The [method] system according to claim 28 [16], wherein the aircraft further comprises a passenger cabin, further comprising [providing of] a pressurized container having sufficient amount of said hypoxic air in order to flood or accelerate the flooding of the passenger cabin and establish[ing] there a breathable fire-extinguishing atmosphere in a case of a fire.
30. (Amended) The system according to claim 28 [and] further comprising
a mixing device for providing, when needed, the mixing of said oxygen-depleted gas mixture with said bleed air in order to increase and regulate the oxygen content in said aircraft space [the cabin and different compartments of the aircraft];
a smoke and fire detection system with sensors installed in said aircraft space [at least one compartment in the aircraft];
an oxygen content monitoring system providing oxygen content data in said aircraft space [said at least one compartment];
a computerized control panel for receiving and analyzing data from the smoke and fire detection and oxygen monitoring systems and regulating the oxygen content in said aircraft space [the protected compartments].
31. (Amended) The system according to claim 28 [and] further comprising means for supplying said second gas mixture directly into said aircraft space [protected compartment] in order to achieve and maintain [the] a designed oxygen content by ventilating the compartment with the oxygen-depleted gas mixture.

32. (Amended) The system according to claim 28 [and] wherein said second gas mixture having oxygen content greater than [9%] 10%.

33. (Amended) The system according to claim 28, [wherein] further comprising means for propelling water by said second gas mixture through a special nozzle for generating water mist inside said aircraft space [the protected compartment].

34. (withdrawn) The system according to claim 28 and a foam producing device for generating hypoxic foam inside the protected compartment by propelling foam generating solution with said second gas mixture.

35. (previously presented) The system according to claim 28, wherein said air-separation device includes a plurality of oxygen-separation membranes connected in parallel in a single unit, so a failure of one membrane does not affect significantly the performance of the whole device.

36. (previously presented) The system according to claim 28, wherein said air-separation device includes a plurality of pressure-swing adsorption modules connected in parallel in a single unit, so a failure of one such module does not affect significantly the performance of the whole device.

37. (previously presented) The system according to claim 28, wherein said air-separation device is a cryogenic unit producing nitrogen and oxygen from air and said second gas mixture is made by mixing nitrogen with the bleed air.

38. (Amended) A method for extinguishing fires using water mist propelled by hypoxic air, said method comprising:

producing hypoxic air in an air-separation device and providing it under pressure for propulsion of water through a water mist generating nozzle;

supplying the system with water for propelling it by said hypoxic air;

producing water mist in a water mist generating nozzle by propelling water with hypoxic air; when deployed, said system generates and releases water mist inside a protected area, said water mist propelled by said hypoxic air that simultaneously gradually dilutes the internal atmosphere and decreases its oxygen content to the fire extinguishing level; the oxygen content in said hypoxic air propelling water mist being above 12% and below 16%;

producing water mist for the period of time needed to establish said fire-extinguishing level; said method designated for extinguishing fires in aircraft, marine vessels, buildings, all type of vehicles and other enclosed and semi-enclosed structures.

39. (Amended) A system for extinguishing fires using water mist propelled by hypoxic air, said system comprising:

an air-separation device providing hypoxic air under pressure for propulsion of water through a water mist generating nozzle;

a water tank for supplying the system with water propelled by said hypoxic air; a water mist generating nozzle producing water mist propelled by hypoxic air;

when deployed, said system generates and releases water mist inside a protected area, said water mist propelled by said hypoxic air that simultaneously gradually dilutes the internal

atmosphere and decreases its oxygen content to the fire extinguishing level;

the oxygen content in said hypoxic air propelling water mist being above 12% and below 16%;

the amount of water in said water tank being calculated to be sufficient to produce water mist for the period of time needed to establish said fire-extinguishing level;

said system designated for extinguishing fires in aircraft, marine vessels, buildings, all type of vehicles and other enclosed and semi-enclosed structures.

40. (Amended) A method of extinguishing fires in aircraft, marine vessels and other vehicles, buildings and tunnels, having a space to be protected said method comprising:

a dilution of the atmosphere in the protected space with hypoxic air having oxygen content below 16% until a fire-extinguishing atmosphere is created;

a maintaining said fire-extinguishing atmosphere at a designed oxygen content level for as long as needed by ventilating said protected space with the hypoxic air with oxygen content ranging from above 12% to 16%.

41. (previously presented)A method of extinguishing fires in aircraft, marine vessels and other vehicles, buildings and tunnels, said method comprising:

a mixture of water mist and hypoxic air having oxygen content above 12% and below 16%; said mixture being generated by propulsion of water through a special mist generating nozzle using hypoxic air;

said mixture, propelled with said hypoxic air, being released into protected area, which allows to rapidly control and extinguish a fire.

42. (withdrawn) A method of extinguishing fires in aircraft, marine vessels and other vehicles, buildings and tunnels, said method comprising:

a mixture of foam and hypoxic air having oxygen content below 16%; said mixture being generated by propulsion of a foam generating solution through a special foam generating device that produces said foam using hypoxic air;

said foam, propelled further with said hypoxic air, being released into protected area, which allows to rapidly control and extinguish a fire.

43. (previously presented) The system and method according to claim 41, wherein the oxygen content in said composition is maintained in the range from 1-15%.

44. (withdrawn) The system and method according to claim 42, wherein the oxygen content in said composition is maintained in the range from 1-15%.

45. (withdrawn) The system and method according to claim 42, wherein said foam is made from a standard fire-extinguishing foam solution that is normally used for propelling with ambient air or nitrogen.

CLAIMS, Set II (preferred)

46. A method for providing a hypoxic fire prevention environment in an aircraft having an enclosed space comprising:

providing a source of hypoxic air having an oxygen content of less than 16% on board said aircraft;
supplying said hypoxic air into said enclosed space; and
establishing an oxygen content in said enclosed space in a range between 10% and 16% during a flight.

47. The method of claim 46 wherein the enclosed space further comprises a cargo compartment and the establishing step establishes the oxygen content in said cargo compartment in a range of between 12% and 16%.

48. The method of claim 46 wherein the enclosed space further comprises a fuel tank and the establishing step establishes the oxygen content in said fuel tank in a range of between 10% and 12%.

49. The method of claim 46 wherein the enclosed space further comprises a fuel tank and the establishing step establishes the oxygen content in said fuel tank in a range above 9% and below 16%.

50. The method of claim 46 wherein providing the source of hypoxic air further comprises receiving a source of air; separating the source of air into an oxygen enriched component and an oxygen depleted component on board said aircraft; wherein said oxygen depleted component comprises said hypoxic air.

51. The method of claim 50 wherein providing the source of hypoxic air further comprises providing a storage container containing hypoxic air under pressure, wherein the step of supplying said hypoxic air further comprises releasing said hypoxic air from said storage container under controlled conditions into said enclosed space.

52. The method of claim 50 wherein the aircraft further comprises a human occupied compartment containing at least one breathing mask, the method further comprising:
supplying said oxygen enriched component to said breathing mask in said human occupied compartment for human consumption.
53. The method of claim 50 wherein separating the source of air further comprises passing the air through a plurality of oxygen-separation membranes connected in parallel as a single unit.
54. The method of claim 50 wherein separating the source of air further comprises passing the air through a plurality of pressure-swing adsorption units connected in parallel as a single unit.
55. The method of claim 46 wherein providing a source of hypoxic air further comprises cryogenically producing nitrogen and oxygen from atmospheric air, and mixing nitrogen and air to form an oxygen-depleted gas mixture as said hypoxic air.
56. A system for fire prevention for an aircraft comprising:
an aircraft having an exterior surface and at least one interior enclosed space;
a source of hypoxic air on board said aircraft connected to supply said hypoxic said enclosed space; and
a hypoxic atmosphere maintained in said enclosed space, said atmosphere having an oxygen content of between 10% and 16% at a time during a flight.
57. The system of claim 56 wherein the at least one enclosed space further comprises a fuel tank.
58. The system of claim 57 wherein the hypoxic atmosphere in said fuel tank further comprises an oxygen content of between above 9% and 16%.
59. The system of claim 57 wherein the hypoxic atmosphere in said fuel tank further comprises an oxygen content of between 10% and 12%.

60. The system of claim 56 wherein said source of hypoxic air further comprises a storage container containing hypoxic air under pressure, and a valve for releasing said hypoxic air from said storage container under controlled conditions into said enclosed space.
61. The system of claim 56 wherein said source of hypoxic air further comprises means for separating air into an oxygen enriched component and an oxygen depleted component, wherein said oxygen depleted component comprises said hypoxic air.
62. The system of claim 61 wherein the aircraft further comprises a human occupied compartment containing at least one breathing mask, wherein said oxygen enriched component is supplied to said breathing mask in said human occupied compartment for human consumption.
63. The system of claim 61 wherein said separating means further comprises a plurality of oxygen-separation membranes connected in parallel as a single unit.
64. The system of claim 61 wherein said separating means further comprises a plurality of pressure-swing adsorption units connected in parallel as a single unit.
65. The system of claim 61 wherein said source of hypoxic air further comprises a storage container containing hypoxic air under pressure, and a valve for releasing said hypoxic air from said storage container under controlled conditions into said enclosed space.
66. The system of claim 56 wherein said source of hypoxic air further comprises a storage container containing hypoxic air under pressure, and a valve for releasing said hypoxic air from said storage container under controlled conditions into said controlled space.
67. The system of claim 56 wherein the source of hypoxic air further comprises a cryogenic device that produces nitrogen and oxygen from atmospheric air, and means for mixing nitrogen and air to form an oxygen-depleted gas mixture as said hypoxic air.
68. The system of claim 56 wherein the at least one enclosed space further comprises a human-occupied passenger compartment.

69. The system of claim 56 wherein the at least one enclosed space further comprises a cargo compartment.